

**Presentation to the Office of Federal Coordinator for Meteorology
Workshop on Multiscale Atmospheric Dispersion Modeling Within the Federal
Community**

on

**The Federal Aviation Administration Needs to Model the Transport of Volcanic Ash
and Other Airborne Hazardous Material in the National Airspace System**

By

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Introduction:

The Federal Aviation Administration (FAA) spends approximately \$350-400M on operational and acquisition programs for aviation weather in support of the National Airspace System (NAS). FAA's aviation weather programs principle mission is to support the detection and monitoring of the atmosphere for the purposes of providing, surface observations, terminal forecasts, and hazardous weather warnings, including the dissemination and distribution of these reports/products to operational decision makers. These operational decision makers include air traffic controllers/flight service specialists, airline operations personnel (i.e., dispatchers), flight crews (i.e. pilots), and airport management/operation personnel. Volcanic ash and other airborne hazardous materials (e.g. toxic chemical clouds and radioactive nuclei) are of particular concern to the aviation industry in that encountering this hazard can result in engine failure to unnecessary diversion or delay in operations. The problem that confronts the FAA is the ability to detect, monitor, and track these airborne hazards for the purpose of eliminating any encounters of volcanic ash and other airborne hazardous materials and to minimize diversions and delays in operations. It is this issue of being able to track and forecast the movement of volcanic ash plumes that this work shop on modeling is principally concerned with. To this aim, the following provides a high level description of FAA's needs to model the transport of airborne hazardous material that could endanger the safety of flight.

Organizational Responsibility:

Within the FAA, the Air Traffic Systems Requirements Service is responsible for establishing and documenting the aviation weather requirements for civil aviation for the NAS. The Aviation Weather Directorate is the point of contact for all issues that relate to aviation weather and is the principle point of contact on overseeing U.S. policy and

requirements to the International Civil Aviation Organization, Annex 3, *International Standards and Recommended Practices for Meteorological Service for International Air Navigation*. Within Annex 3, the U.S. has agreed to adopt the standards and recommended practices for the reporting of volcanic ash. In this regard, the U.S. has established two Volcanic Ash Advisory Centers (VAAC), one in Anchorage and the other in Washington, to provide support to Meteorological Watch Offices (MWO) in the detection and forecasting of ash clouds. Volcanic Ash Advisories are sent to area control centers (ACC) and MWOs for the purpose of issuing NOTAMS and SIGMETs which serve to warn airline operation centers (AOC) and flight crews of the hazard. Part of this advisory information is based on the Volcanic Ash Forecast, Transport, and Dispersion Model (VAFTAD) which provides guidance on the current location of the ash cloud and forecasts the expected location at fixed flight levels and prescribed periods. The FAA does not possess or have the ability to operate a transport model but relies on the National Weather Service (NWS) and National Environmental Satellite, Data and Information Service (NESDIS) to operate the model and provide the necessary guidance. The FAA provides the operational requirements for the services needed to support a safe and efficient NAS to the National Oceanic and Atmospheric Administration (NOAA).

Issues:

The principal concerns associated with volcanic ash is related to engine failure and maintenance of the aircraft. Volcanic ash poses a danger to civil aviation in several ways by:

- Fusing to compressor and turbine blades, leading to complete engine failure,
- Abrading cockpit windows
- Abrading airframe and flight surfaces, thereby lessening aircraft performance
- Clogging the pitot-static system, producing inaccurate airspeed and altitude inputs to the navigation system,
- Damaging the air conditioning and equipment cooling system, and
- Contaminating aircraft avionics and fuel.

Volcanic ash can be present at any altitude and is a threat to all categories of aviation. Of greatest concern are those eruptions where ash is ejected to operational flight altitudes in remote regions of the world. It is for these reasons, that the aviation community needs to know the current and forecasted location of any existing ash cloud.

Similar to volcanic ash are those issues that relate to a toxic chemical cloud or the release of radioactive nuclei into the atmosphere. The principal concerns associated with a toxic chemical cloud is that gases entering the flight crew deck could incapacitate the crew effecting their ability to control the aircraft during a critical stage of flight such as takeoff or landing. As to radioactive nuclei released into the atmosphere the greatest concern is the exposure of the flying public to radioactive material/gases. In this vein ICAO is in the process coordinating with the International Atomic Energy Agency (IAEA) and the World Meteorological Organization (WMO) regarding the provision of forecast

trajectories for wind-borne radioactive debris. At this time, no firm standards have been established except the requirement, that should there be an accidental release of radioactive material into the atmosphere, a notification will go out on High Level Significant Weather Charts to alert airline operation centers and flight crews of the potential hazard. Further operational procedures and guidelines are in development as to how the WMO Regional Specialized Meteorological Centers are to support ACCs.

Operational Requirements:

The FAA is in the process of documenting the operational requirements for the reporting and forecasting of volcanic ash and other airborne hazardous material. To accomplish this the FAA has established a user needs analysis team whose purpose is to document current capabilities and future or planned operational capabilities. The gap or short fall between current and planned operations are the unfilled documented requirements. As a base, the FAA has agreed to abide by the current SARPS in Annex 3, however, the guidance in the Annex does not adequately address the specific requirements that controllers, operations center personnel, flight crews, and airport managers need to make for tactical and flight planning decisions. To this aim, the FAA is setting out to document those requirements. Issues that relate to resolution, accuracy, frequency of model runs, top/bottom of ash clouds, cloud density, deposition rate, dosage, outlook, etc. are to be addressed. At the end of this analysis, the FAA will have firm requirements as to what is required by users of the NAS to operate in a safe and efficient manner. These requirements will be forwarded to appropriate Federal agencies, principally NOAA, so their forecasters and modelers can develop the necessary technology/algorithms to support the operation of the NAS.

Summary:

The purpose of developing the operational requirements for tracking and forecasting the transport of volcanic ash or any other airborne hazardous material is to support the tactical and flight planning decisions that are made by air traffic controllers, airline operation centers personnel, flight crews, and airport managers. The FAA depends on other federal agencies such as NOAA to help meet this requirement.